Use of Fish Species-specific Selenium Toxicity Thresholds in Bioaccumulation Models

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Overview

- Questions:
  - How may fish species-specific Se toxicity thresholds be incorporated into Se bioaccumulation models?
  - How would this information be used to identify protective water quality objective or criterion for Koocanusa Reservoir?
- Following slides present a conceptual example

Sensitivity of Fish to Se

- Sensitivity of a fish species to Se is a function of both toxicity (concentration-response; EC10) and exposure (bioaccumulation), for example:
  - If 5 fish species occur in a system with a given water Se concentration, their order of sensitivity within the system is not based just on their EC10s nor on their Se bioaccumulation potential, but the relative combination of the two
  - The fish with the highest tissue Se concentrations may not be the most sensitive because it also depends on the Se tissue toxicity threshold, which is also species-specific

Hypothetical Example for Chemical X

- Assumptions:
  - 3 fish species have species-specific EC10s (Species A, B, and C) and 2 fish species do not (Species D and E; a fish tissue-based guideline is assumed)
  - All fish 5 species have species-specific bioaccumulation factors
  - The water concentration predicted to result in the toxicity threshold for each species is calculated by dividing the toxicity threshold by the BAF

Parameter	Species A	Species B	Species C	Species D	Species E
Toxicity Threshold (mg/kg)	150 (species-specific EC10)	300 (species-specific EC10)	200 (species-specific EC10)	100 (guideline)	100 (guideline)
Bioaccumulation Factor (L/kg)	75 (species-specific)	100 (species-specific)	50 (species-specific)	25 (species-specific)	20 (species-specific)
Predicted Water Concentration (mg/L)[1]	2	3	4	4	5

[1] Pred. Water Conc. = EC10 ÷ BAF

In this scenario, Species A, with an intermediate EC10 and BAF relative to the other fish species, would be the basis for a protective water quality objective [4]

Summary and Recommendations

- Sensitivity is a function of both toxicity and exposure
- Species-specific Se bioaccumulation models should consider species-specific Se toxicity thresholds when available
- Only incorporate Se guidelines or criteria for species lacking Se toxicity data
- "Levels of Protection" could be worded to capture the concept that species-specific EC10s would be incorporated where available